Aurora Australis JGOFS Cruises in the Southern Ocean
DATA DOCUMENTATION

P vs I Determinations

Cruises AU 9101, AU9303, AU 9404, AU9407, AU9501, AU 9604, and AU 9706

[1] General:

Parameter:	Photosynthetic parameters and chlorophyll a for cruises AU 9101, AU9303, AU 9404, AU9407, AU9501, AU 9604, and AU 9706 These parameters were obtained from fitting the models of Platt et al., 1980, to carbon uptake vs light intensity results from a small-bottle production vs light intensity experimental series.
Level 1:	Yes
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List of Parameters:

Depth: depth in metres that the niskin bottle was closed.
Pmax: This is the maximum carbon fixation rate at saturating irradiances. Where no beta parameter is listed, it is equivalent to P_m^B (see Platt et al. 1980). Where a beta parameter is listed, it is equivalent to P_s^B. Units are mg Carbon [mg Chlorophyll-a] $^{-1}$ hr^{-1}.

Alpha: this is the initial slope of the Production vs Irradiance curve. Units are mg Carbon [mg Chlorophyll-a] $^{-1}$ hr^{-1} (μmol m^{-2} s^{-1}) $^{-1}$.

Beta: this is the photoinhibition factor. Units are mg Carbon [mg Chlorophyll-a] $^{-1}$ hr^{-1} (μmol m^{-2} s^{-1}) $^{-1}$.

Intercept: The P-I curve is not constrained to pass through zero due to occasional high positive intercepts, usually associated with nitrite in the nutrient profiles. The intercept has been standardised by dividing by chlorophyll-a.

Chlorophyll-a: HPLC chlorophyll a values from the same niskin that the productivity samples were taken. The units were mg m^{-3}

List of Units: see above.

[2] Sampling:

Gear (e.g. CTD, pump, etc.):	CTD; 10 litre niskin bottles
Standard Depths:	Hydrochemistry depths: see Hydrochemistry data
Chemicals used:	none
Special Procedures:	Niskins with silicone rubber o-rings and closure rubbers. Carbon fixed vs light intensity (P vs I) incubations using ^{14}C were started within one hour of the CTD coming on deck and one hour incubations (range 55 minutes – 80 minutes) were standard. P vs I parameters were determined after fitting the models of Plattt et al., (1980) to the carbon uptake standardised by chlorophyll a (mg Carbon (mg chl a)$^{-1}$ h^{-1}.
Comments and Notes:	Sampled in dim light.

[3] Analysis:

Instrument:	Photosynthetron described in Mackey et al., (1995, 1997).
Method:	Described in Mackey et al., (1995).
Precision:	Carbon fixation in the P vs I curves: At chlorophyll levels less than about 0.04 μg l^{-1} the expected P vs I response was often not consistent, especially in surface samples (see below). Curve fitting: curves not showing photoinhibition were classifed as not able to be fitted if the standard error of the parameters exceeded 30%. Curves showing photoinhibition were classified as not be able to be fitted if the standard error from the fitting exceeded 40%.
Comments:	FR 9308: Due to loss of all pigment samples on FR 9308, chlorophyll *a* was estimated using the mean fluorescence measured as the niskin bottle closed and using the hplc chlorophyll-a: fluorometer calibration from be estimated FR 9205.

[4] Results:

Quality of Data: Good but see known problems below

Known Problems:

AU9101: none. Fluorometric profiles made separately to but within ± 30 minutes the CTD and water sampling cast.

AU9303: none. Fluorometric profiles made separately to but within ± 30 minutes the CTD and water sampling cast.

AU9404: none

AU9407: none

AU9501: rough cruise, few stations able to be worked

AU9604: fluorometer flooded on second station. Chlorophyll profiles for production modelling constructed by linear interpolation between adjacent depths using HPLC chlorophylls from these depths. The difference between profiles constructed this way, and

from fluorometer profiles converted to chlorophyll-a ranged between –11% to +23%, with a mean difference of +8.7% (data from AU 9704 and using 15 profiles).

AU9706: none.

[5] Brief description of analytical methods

P vs I method.

A photosynthetron (Mackey et al., 1995) was used to obtain estimates of carbon fixed per hour. The photosynthetron used on AU9101 could handle a maximum of 5 depths with 18 different light intensities plus 3 samples incubated in the dark. On the remain cruises, the photosynthetron could take 7 depths. There was a range from zero irradiance to at least 600 μmol m^{-2} s^{-1} with at least 9 intensities below 100 μmol m^{-2} s^{-1} in both incubators. These data points were standardized to chlorophyll-a, and then examined for obvious outliers, which were removed. Curves were fitted using a non-linear regression technique to fit the models of Platt et al., (1980) in the statistics package Systat. If the standard error of the estimates was greater than 30% (40% where photoinhibition was present) the data were examined for outliers and these points removed. The curve fitting routine was then run again. If the standard errors could not be reduced to these limits, the depth was not included in the results. Some deep samples were rejected due to erratic carbon uptake.

References:

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[6] Comments:

None